JUNE 25, 1984

CHEMICAL & ENGINEERING

NEWS

CALENDAR OF EVENTS
Scientific meetings Page 40

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Major thermoplastics production to hit all-time high this year

A Key Polymers Review Page 13

CHEMICAL & ENGINEERING
NEWS

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JUNE 25, 1984

News of the Week

■ **Compromise bill would reduce U.S. Synfuels Corp. to little more than a federal grant agency.** **Page 4**

■ **FDA advisory committee recommends approval of Merck's enalapril to treat high blood pressure.** **Page 5**

■ **U.S. manufacturers must step up automation to survive competition, forum reports.** **Page 5**

■ **EPA deputy administrator relates agency's accomplishments.** **Page 5**

■ **Conservation Foundation report says environmental laws need revising.** **Page 6**

■ **Tests of cheese made with rennin produced by recombinant DNA technique are successful.** **Page 6**

Business

Demand for thermoplastics continues to rise, although at a slower pace than in 1983, leading to tight capacity for some. **Page 13**

International Business

Canadian proposal for duty-free sectors in U.S. trade could apply to petrochemicals if industry, government concur. **Page 19**

Government

International conference expected to shed light on yellow rain toxins as chemical weapons was inconclusive; universities lobby Congress for funds added to appropriation bills. **Page 25**

Technology

A continuous process to strip dissolved metals from wastewater streams developed by GE chemical engineer. **Page 33**

Education

SERAPHIM project's goal is to provide microcomputer software packages for chemical educators; ACS survey of 103 chemistry departments confirms need for up-to-date instruments. **Page 34**

Books

Two books on creation of the universe, by astronomers, physicist, differ strikingly in both style and organization. **Page 37**

Meetings

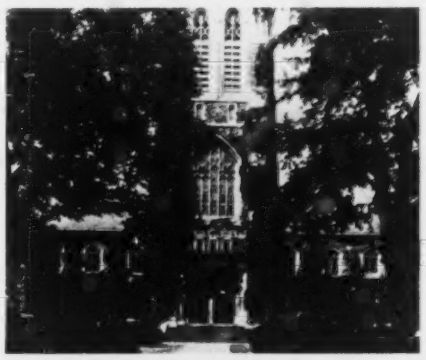
C&EN's semiannual calendar of events lists meetings of interest to chemists and chemical engineers through June 1985. **Page 40**

Cover: Du Pont's new high-density polyethylene plant in Matagorda County, Texas

Letters 2
Editor's Page 3

Concentrates
Business 12
Government 22
Science/Technology 32

The Departments
ACS News 38
Awards 39
Newscripts 60



News Focus

University research capitalized by industry is the target of critics who claim ethics, social values are ignored. **Page 7**

University/Industry Research Ties Still Viewed with Concern

Critics insist that universities are violating obligations to science and society by marketing expertise to industry; small colleges feel left out of trend

Wil Lepkowski, C&EN Washington

Interest appears to be rekindling around the issue of "collegiate capitalism," or more specifically, the impact of industrial money on the identities of university researchers and their institutions.

Arguments are being refined, regulations and laws are being examined, university policies are being formed or reworked—all to explore what mutations the research universities are undergoing in their quest for the corporate dollar.

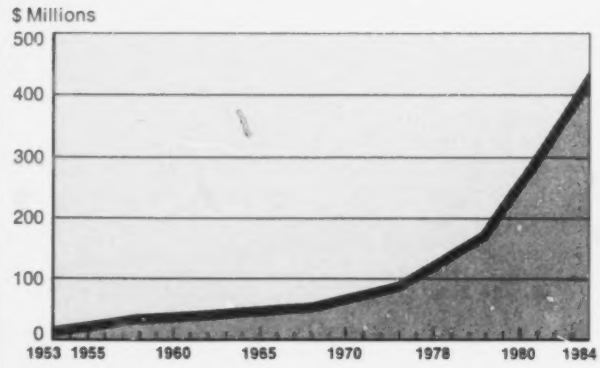
New laws passed by Congress and federal sponsorships of cooperative research between industry and academia hurry it along. A key spur is the right of universities to license their federally funded technology on an exclusive basis to corporations. A further catalyst is the campaign by states to spin their economic development around research parks funded by industry and staffed mainly by university scientists.

"Some may think the conflict of interest issue has waned, but I don't think so at all," says John D. Holmfeld, a senior staffer for the House Science & Technology Committee. "We've seen no overt scandals, but we're just waiting for the next unfortunate incident to occur. I can visualize some professor with a stake in a corporation withholding information from his colleagues by refusing to publish, pending patent protection, then having colleagues blow the whistle on him or her. There are many out there in academia looking for instances."

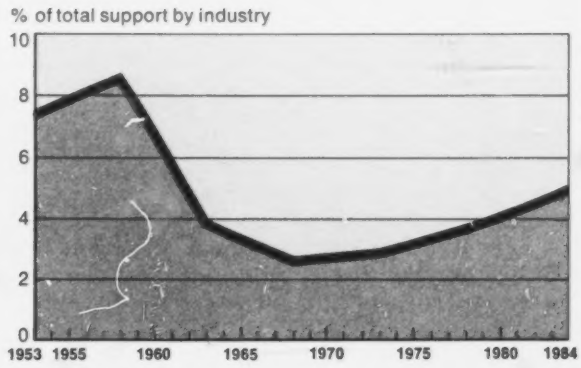
One of the leading professorial critics of the phenomenon is Sheldon Krimsky, associate professor in the department of urban and environmental programs at Tufts University. He believes that the involvement of biologists in the university/industrial complex is especially unfortunate.

"The types of university-industry relationships in biology are more varied, more aggressive, more

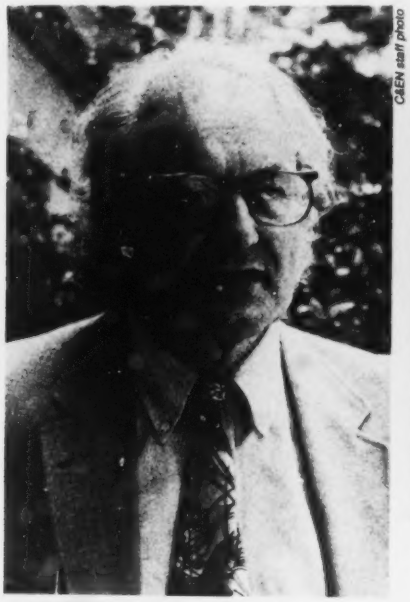
Industry's support of academic research is up sharply...



...and its share of total support is rising after 1960s decline



Source: National Science Foundation



Minsky (left): populist values should reign. Starr (above): small colleges deserve more. Rosenzweig: keep the federal government out

experimental, and more indiscreet than they had been in similar historical circumstances," he says. "A significant number of new firms in biotechnology sprung out of academia. The intense commercialization of biology could result in an enormous social liability," he believes.

The development of the commercial mind-set in academia takes insidious directions, Krimsky believes. "The new values emphasizing science for commerce become internalized and rationalized as a public good," he theorizes. "It happens incrementally, without conspiracy or malice. Scientists and engineers with a stake in the commercial outcome of a field cannot at the same time retain a public interest perspective that gives critical attention to the perversion of science in the interests of markets. If you have too many scientists involved with corporations, how can the public have confidence that those scientists will provide objective expertise when biotechnology becomes, as it is, an environmental and public health issue? The result could be a scarcity of disinterested experts when controversial issues reach the public policy stage."

The issues will be examined over coming months by Ralph Nader's new group, the Center for Universities & the Public Interest, headed by former educator Leonard Minsky. The center was formed only three months ago and is in the process of incorporating as a nonprofit institution.

The goal of the new center, says Minsky, "is to oppose the industrialization and 'corporatization' and the militarization of research in universities. We're also opposed to any attempts made by the ideological Right to use universities to give a gloss of credibility to what are essentially ideological positions. We're going to try to show in concrete instances what the alternatives have been and will be if corporations and the military have their say in setting the agenda for the universities."

Minsky says he plans to begin a membership drive this fall. The working agenda will include meetings, conferences, speeches, and the launching of a major "Nader raider" type investigation of abuses of the academic ideal. That will begin, he says, in a little more than a year. "We hope to be able to offer community groups information on subjects concerning their difficulties with environmental problems impacting the community that have an ideological dimension. We will draw most of our support from academics who now are powerless and support from the community once we have shown our usefulness. We believe there are hundreds of instances of faculty [members] who are fired for their views. We mean to bring home to scientists the social consequences of their work."

Says Minsky in a perspective paper he has just written: "When university researchers are en bloc consultants, when funds are specifically tied to the generation of commercially useful products, and when corporate scientists effectively choose the topics of research for university scientists, we have reached an entirely new level of corporate control. The profit motive must now necessarily dominate the consciousness of professors and students alike."

Minsky's ideas come from his own populist perspective. But establishment academics are no less critical.

Eric Holtzman, chairman of the department of biological sciences at Columbia University, thinks the problem is getting more serious for two reasons. The first is that because of the privatization of knowledge, needed biological information could be withheld from developing countries where it could be used effectively. The second is the more often expressed concern that scientists are clamming up in the sharing of information about what he calls "tricks of the trade," or laboratory methodologies in areas such as gene splicing or fermentation.

Holtzman acknowledges that chemistry and physics have adapted the respective ethoses to commercial realities and have adapted their own rules of the game. "My fear," he says, "is that the biological modus vivendi will corrode what has been an open society in biology."

At present, he doesn't think it will be possible to get any detailed data on the degree of involvement. "It's a matter of small decisions being made by a large number of people in numerous circumstances," he says. Biologists are "sworn to secrecy" in occasional collaborations. Violations of the tradition of openness have occurred to a minor degree so far, he says. "But it's in the air; people are talking about it."

Holtzman says that three things can be done to prevent monopolization. First, international flow of knowledge to developing countries, where it's most needed, has to be facilitated. New organisms important for medicine and agriculture should not be national or private property.

Second, Holtzman believes new forms of biotechnology production facilities need to be developed, not entirely public, not entirely private. They would be experimental at first and would operate under the principle that the new biology represents a massive public investment and therefore needs to be put under some public control.

But that wouldn't be the only reason. Just as important is the principle that the new biology has immense long-term implications and therefore should not be guided by the short-term interests of traditional mercantilism. Just what these new "biological utilities" would look like is far from clear. But they would require lots of thought, small-scale experimentation, and therefore most likely legislation, Holtzman believes.

And third, he says, scientists have to start talking about the dangers more among themselves. They need to discuss the long-term health of their enterprise. "People are tangentially aware of the problem," he says, "but it hasn't really come home to them yet."

John C. Chester, assistant to the general counsel at the National Science Foundation, says the foundation is about to launch an inquiry into whether its grant recipients who also have corporate ties are suppressing data because of allegiance to their corporate sponsors. For example, suppose the privately and publicly funded research overlaps. And suppose the research results are patentable. Does the scientist have the right to withhold the information until the patent is filed?

"Questions come up with respect to how much work that a person does should be reported and made available," he says. "Right now NSF has a laissez faire attitude. Nothing leads us to suspect it is not true. We hear stories, especially in biotechnology, where a patent attorney is standing by a scientist at a meeting, telling him or her what to and what not to say for fear of revealing patentable information."

One academic scientist, John E. Gander, chairman of the department of microbiology and cell science at the University of Florida, is distrustful of any deep government intervention of that type. At the same time, he acknowledges that the amount of faculty involvement with industry is much more extensive than the public is aware of.

"The problem we are talking about is basically one of human behavior," he says. "There will always be people who will try to manipulate the system for their own ends. And complex bureaucracies would allow a conflict of interest to be buried so deep that it wouldn't be detected. Others less savvy may slip up. And when they do, the whole community will be discredited. The best thing that one can say about what should be done is that people in science who are not involved with industrial ties should get together and set up sets of principles or regulations, not the bureaucrats. This would be a process parallel to the peer review system."

Joseph E. Varner, a biochemistry professor at Washington University who does considerable consulting with nearby Monsanto, says the principal place where conflict of interest arises is where graduate students may be doing work related to the industrial program. "So we here simply don't have students work on any of the projects with Monsanto. We also have some grant money from Monsanto where there are no strings attached. But we don't support graduate students on that, either.

"But with postdoctoral students and faculty, Monsanto wants to have a rough draft of a paper a month ahead of the time it is to be submitted to a journal. So far, there's been no trouble at all. We do the fundamental work we propose to do.

"In the consultant work, we do see privileged information and it is up to our own good sense and judgment to avoid using that information in our own research. We do see sensitive stuff and if we get into trouble, it's our own fault. But consultants have always had that problem.

"On equity positions with companies, I know I'm hopelessly out of date on this, but I don't think any

Virginia Polytechnic has largest share of industry-supported research

Rank[a]		R&D expenditures[b] ($ millions)	Total from industry ($ millions)	Per cent
59	Virginia Polytechnic Institute	$39.9	$6.5	16.3%
26	Georgia Institute of Technology	71.4	11.4	16.0
99	Rensselaer Polytechnic Institute	20.3	2.8	14.0
63	Carnegie-Mellon University	37.4	4.8	13.0
24	Pennsylvania State University	82.0	10.6	12.9
46	Colorado State University	46.6	5.1	11.0
30	Purdue University	67.3	7.4	11.0
96	Brown University	21.3	2.2	10.5
87	Clemson University	23.5	2.3	9.8
21	University of Arizona	88.2	8.6	9.7
2	Massachusetts Institute of Technology	157.2	17.2	8.9
42	University of Miami	51.9	4.6	8.9

a In total R&D funding. b Amounting to $20 million or more as of fiscal 1982. Source: National Science Foundation

university professor ought to be in the position of making money on his own work if he's already been bought and paid for by NIH or NSF. So it's only common sense and good ethics to go back to public responsibility."

The key issue, according to Howard W. Bremer, patent attorney for the Wisconsin Alumni Research Foundation (the patenting, marketing, and licensing organization for University of Wisconsin research), is that the university doesn't wind up being a research arm for industry: "That may be an incursion on academic freedom." There are no spectacular legal battles occurring right now, Bremer says, but there could be in the future, or if not that, at least a lot of pain for the universities.

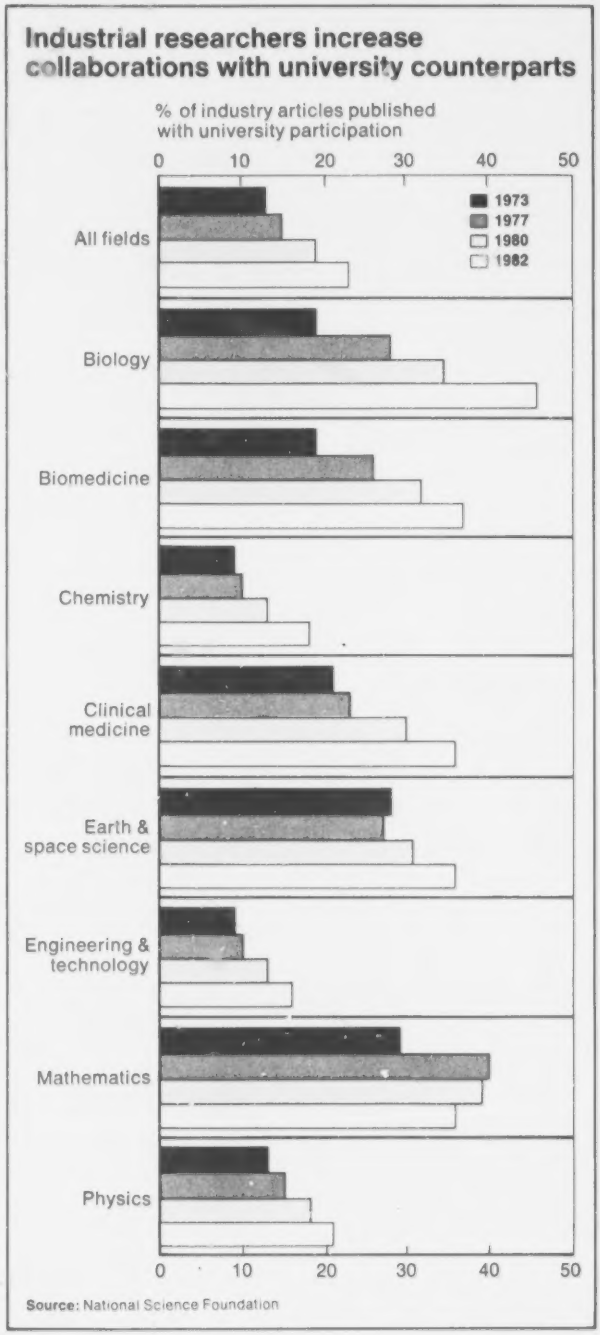
Bremer says the investigators and their universities must be extra watchful over the wording of contracts drawn up between the researcher and his department and the contracting company. "What people don't seem to realize even now," he says, "is that the knowledge being negotiated has been built upon 10 or 15 years of funding by others in any particular area. And the contracting companies simply seem to want to walk away with the fruits of all that research.

"Universities particularly have to watch where federal money is involved," he adds. "Most of the basic research in universities is still supported by the federal government, and so there's always the potential for the commingling of funds. It's obvious that the professor is being sought for his expertise that was gained across the funding spectrum."

Another aspect of the debate relates to technological change itself and its impact on labor and society, rising from the revolution in microelectronics, robotics, artificial intelligence, and computer-assisted manufacturing. The question is whether universities by their ties to corporations are directing technologies away from more humane directions. Inherent within that is a traditionally blue-collar distrust of big corporations.

The issue was legally underscored earlier this year when the California Rural Legal Assistance Agency sued the University of California, Davis, over the support of research on automatic harvesters that eliminated jobs of manual pickers. Was this a socially optimal technology? Weren't public universities also in the business of enhancing the employment system in the state? Wasn't the preservation of jobs an economic good? Was a public university reflecting only the values of the corporate ethic, which has always been to raise productivity?

The computer-assisted design and manufacturing revolution is illustrative. Again, corporations are funding universities to help them further develop fields of automatic control. Progress in the field is sure to eliminate jobs. Isn't it the obligation of universities to pursue parallel research in examining whether such developments are socially optimal? Must the productivity-conscious managerial mentality prevail? Is all progress defined as that which assures automatic control of systems? What is really wrong with labor-intensive technology? Might it not be more productive in the long run?



"The claim that [computer-assisted design and manufacturing] increases productivity and competitiveness has not been proved or is at best ambiguous," says David Noble, curator of industrial automation at the Museum of American History in Washington, D.C., and associate professor of history of technology at Massachusetts Institute of Technology. "All it does do is reduce the direct labor costs, which are usually about 10% of the total manufacturing costs. In effect then, you are eliminating the blue-collar worker with-

out necessarily increasing the output or unit costs." Noble, incidentally, is waging warfare against MIT for refusing to grant him tenure last year. He claims he was discriminated against by his outspoken disagreements with MIT research policies that he argues skewed technology away from public concerns. Another reason, Noble suggests, was the content of his new book, "Forces of Production—A Social History of Industrial Automation," in which he challenges conventional assumptions about automation and MIT's role in development of that technology.

The problem in the university, he says, is that "we are not allowed to pose the questions. To now, the questions relate only to the human interest rather than what we are going to do. We have to do more than just lament the plight of displaced workers. There's no compelling moral or rational reason preventing a moratorium on the introduction of new technologies, pending the solution of serious social problems. This would only be sound policy."

And Alden S. Bean, professor of management and technology at Lehigh University, says the university role may be to judge technology, but a more basic role is to train students to use it.

"My attitude is that the university is created so all the issues pertinent can be heard and debated," he says. "And the university should be rooted in its region and responsive to its constituencies. So nothing is all that conflicting. It must look at the broader set of long-term issues. We're not going to dismantle the [computer-assisted] technology nor is industry going to stop promoting it. And the students are not going to stop demanding educational opportunities. At the same time, the political science and labor economics faculty have to aggressively tackle the issues raised by the technology." Bean adds that there always has been structural unemployment during technological change in society.

Indeed, Robert Rosenzweig, president of the Association of American Universities, says the issue of faculty conflict of interest really needs a lot of attention. "The desire to attract more industrial research to the campus has created the need to understand the legal and ethical issues." As a start, AAU has established at the request of Congress a clearinghouse on corporate/academic ties to assess how different institutions are establishing working relationships with corporations and avoiding conflict of interest at the same time. A summary of the findings is due to reach Congress in October.

Rosenzweig has no problems with the general idea of industrial support for academic research. But he wants the rigid hand of regulation kept out of the system.

"I don't know how well most institutions are in control of these issues. There is greater sensitivity than there was three years ago. But I'm not sure how many universities want to make the effort to find out how individual faculty members are behaving. And on the whole I think they are right. If you go about the business of learning the way people behave you are under obligation to do something about it. And I'm not sure that the whole process wouldn't produce more trouble than it would be worth.

"These are issues that ought to be dealt with by exception—by violation of procedures and policies—than by any systematic enforcement."

Curiously, one important element of the country's system of higher education feels it is being left out: the private, high-quality liberal arts colleges that supply much of the talent to the graduate schools.

Oberlin president S. Frederick Starr, a historian, is heading a group of 35 such schools and has called for a fall meeting to be held at Oberlin to discuss "the future of the scientific enterprise in the small liberal arts college" in the face of what he sees as favoritism by the government and industry toward the research university. "One issue," Starr says, "would be the relationship that exists between the National Science Foundation and the research universities. To us, it seems that NSF's relationship to them is similar to the relationship that exists between the Pentagon and the arms producers." One would think, he says, that a college like Oberlin, which produces more than the average number of science students for the graduate schools, would be seen as a valuable resource by NSF and the corporations.

He also is disturbed by recent shifts downward in the proportion of corporate support for research at the undergraduate science level. "We get 17% less proportionately than we got five years ago," he says. He calls the drop an "alarming trend." "I would think U.S. industry would appreciate us as a resource and provide more direct support so as to preserve our strength."

It is difficult to arrive at any clear set of conclusions from this rapid and necessarily superficial excursion through a field of intense philosophical and economic debate. Biotechnology and computer-assisted design and manufacturing technology, along with all the other fields whose knowledge is for sale, represent individual, separate technical worlds. And yet in their intense energy to grow and transform society, they collectively challenge institutions of higher education to re-examine themselves.

Certainly, a case can be made that economic and industrial assistance (which is really what all these collaborations are about in the broader social scheme) fall within the range of the university's public service function. This is still a capitalist society, the form that is arguably most compatible with democracy. Still, people are concerned that universities will lose their critical functions at a time when that higher form of public service is perhaps needed most.

If universities forfeit honest social criticism to, say, journalism or television talk shows, they leave it in superficial hands. What does seem at stake is the teaching and practice of broad critical thought—an intellectual resource that many believe is under dire threat today when economic values of the marketplace appear to reign supreme. Universities might say they need the money, professors might say that work with industry broadens their usefulness to society and their students. But, the public citizen might still ask, at what cost? □

Upswing Continues in Demand for Thermoplastics

Rise in consumption, though at slower pace, begins to push limits of this year's available capacity for some major-volume plastics

Bruce F. Greek, C&EN Houston

Producers of thermoplastics are happily riding a strong upswing in demand for their products. The vigorous rise in consumption that began last year carried over this year, although at a slightly slower pace. But it is continuing at a good enough rate that two of these thermoplastics, high-density polyethylene and polypropylene, will flirt with total utilization of the effective capacity to make them this year.

The other three major-volume thermoplastics—low-density polyethylene, polyvinyl chloride, and polystyrene—have varying degrees of overcapacity. Like polypropylene and HDPE, these plastics are experiencing sizable gains in production but have further to go to overcome the large buildup of capacities in the late 1970s and early 1980s.

Production for 1984 for these five major-volume thermoplastics is forecast to add some 2.3 billion lb to the 1983 total, bringing combined output to a record of more than 30 billion lb, representing an annual growth rate of about 8.3%. This gain is less than that in 1983, when recovery from the recession accelerated and production rose more than 14% from the depressed level of 1982.

Key Polymers

The dollar value this year will be up even more than production volume. Total value of 1984 production is expected to be up more than 40% from last year to nearly $12 billion. That would be 70% more than 1982's depressed level of less than $7 billion.

Clearly, profitability has improved for the five major thermoplastics. Part of the large value increase comes from substantial rises in list prices that began in 1983 and have continued into 1984. Even more important than higher list prices, actual selling prices also have improved substantially, with discounting considerably reduced this spring. Prices for the rest of 1984 are expected to hold at about current levels, subject to the usual pass-throughs of raw material cost changes.

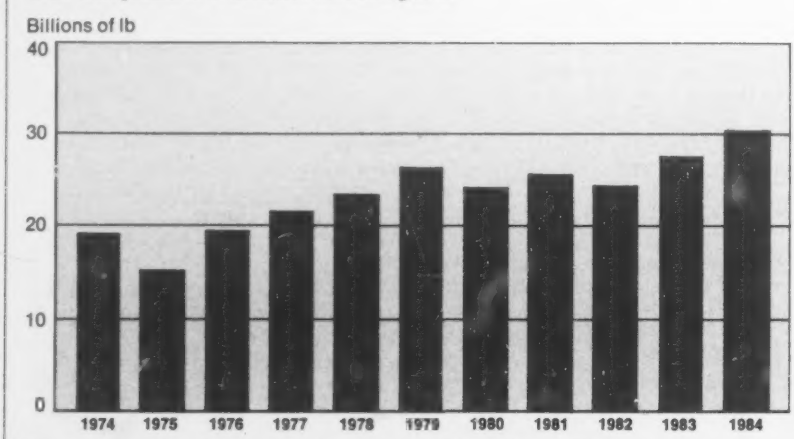
Longer term, production values in this cyclical business are expected to continue to rise except for the dips caused by economic recessions. However, these rises may be considerably smaller than those of 1983 and 1984. Both production volume and actual selling prices probably will not rise so fast over the next five years as they rose in 1983 or are rising in 1984.

The reasons for slower gains involve the maturing of the big-volume thermoplastics. Marketers expect growth to be hindered by problems now developing. For instance, a decline in exports plus a possible rise in imports will require U.S. markets to absorb the additional volumes of products, and fewer markets of other materials such as glass, paper, or wood are left that plastics can capture.

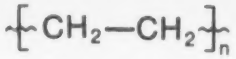
Smaller growth rates than those of the 1970s are now widely accepted by all but the most determined optimists. Depending on the specific thermoplastic, the rates now forecast for the next five years are mainly in the 3 to 7% per-year range.

For details of the near-term outlook for these major thermoplastics, see the following pages.

Combined production of five leading thermoplastics will surpass 30 billion lb this year



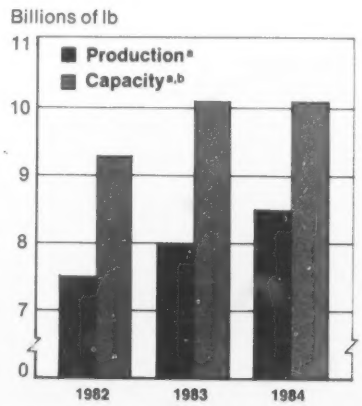
Sources: Society of the Plastics Industry's Committee on Resin Statistics, C&EN estimates



Low-density polyethylene

- ***Demand rising***
- ***Capacity on hold***
- ***Prices up***

PRODUCTION/CAPACITY



a Includes linear low-density polyethylene. b First quarter.

HOW MADE

Polymerization of ethylene (with comonomers as required by product needs) at high and low pressures aided by catalysts and initiators

MAJOR FABRICATED FORMS (U.S.)

Film (mainly for packaging) 65%, injection-molded items 10%

FOREIGN TRADE

Exports—may decline to below 750 million lb in 1984, imports—small, below 100 million lb in 1984

PRICES

List prices 38 to 43 cents a lb for large-volume grades, discounting lessening

COMMERCIAL VALUE

$3.4 billion for estimated production, 1984

Another fairly good year is under way for low-density polyethylene. Production, demand, and even profitability of producers will be better than they were in 1983. But to several industry sources, 1984 will not be so good as it could be.

Production of all forms of LDPE (that with densities of 0.94 or less) likely will total 8.5 billion lb in 1984. Placed on an annualized basis, production during the first quarter of this year ran just a bit below the 8.5 billion lb-a-year pace. However, these are preliminary data that often are revised upward.

According to a more optimistic scenario for 1984 low-density polyethylene production, the total for the year should amount to about 8.7 billion lb. This 8.7 billion lb total even allows for some of the usual slowdown in production during the third quarter.

Capacity for LDPE is more difficult to pin down than for other major-volume thermoplastics. An average estimate from a number of sources is that total capacity was a bit more than 10 billion lb at the beginning of the year. This figure causes considerable head-shaking among some sources because of the moves into linear low-density polyethylene by several companies by building new plants and converting some older high-pressure process technology plants, and also because of shutdowns of some of the old units that might yet be converted for making LLDPE. Probably if all installed capacity to make various forms of LDPE were counted, the total would be as much as 10 to 20% higher.

Obviously, economics determine the future of the shut-down older plants. Further conversion of these units to make LLDPE gets less likely as time goes by; rather, dismantling of these units becomes more likely.

Another topic subject to disagreement among marketing experts is that of the amount of LLDPE capacity that actually will produce high-density polyethylene this year. Although enough capacity exists to allow considerable HDPE to be made if desired, such activity will make the plant operating rate higher than it would be otherwise. Again, economics will determine what is made in these convertible units. Producers will run plants as necessary to fill sales needs with the result that any given producer could have a different product mix from the other producers.

Thus, any estimate of plant operating rate is necessarily more general for LDPE than for the other thermoplastics. Considering the range of production estimates, the operating rate may turn out to be 83 to 88%.

Strong arguments can be made for either end of that range. For instance, in favor of the high end are doubts about the highest estimates of available capacity, not to mention the possibility that demand might prove better than forecast later in the year as the continuous development of polymers better suited for specific uses aids sales. On the other hand, in support of the lower capacity use is the continuing problem of inventory-building in LDPE. Sales and captive use through the first quarter increased less than did production, according to the Society of the Plastics Industry's Committee on Resin Statistics. In March, sales were actually off a bit from March 1983, even though production in March 1984 was above the year-earlier month.

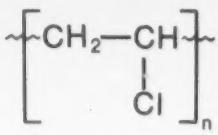
No important changes in the uses of LDPE appear to be in store that might affect production. Films continue to dominate uses at nearly two thirds of the total domestic consumption. The impact of LLDPE on the film uses of conventional low-density product seems to be lessening as blends of the two types of polyethylene get wider use.

Exports of LDPE now look as if they will be down about 150 million lb in 1984 from their 1983 total. Behind this decline will be the continuing strength of the dollar, as it hits all exports, and increasing capacity to make polyethylene in other parts of the world by companies, some of which are government-owned or -dominated, that must sell production at whatever price they can get.

Thus, U.S. producers of LDPE will have to work hard to achieve a gain in volume this year equal to that of last year. This will be especially difficult since some of the U.S. demand will be filled by product that otherwise would have been exported.

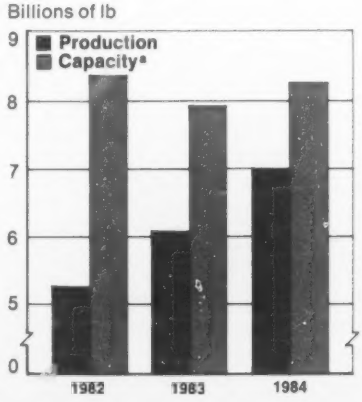
Key Polymers

Polyvinyl chloride



- ***Demand well up***
- ***Capacity to rise***
- ***Prices stronger***

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Polymerization of vinyl chloride by suspension, emulsion, bulk, or solution processes initiated by free radicals

MAJOR FABRICATED FORMS (U.S.)

Extrusions, nearly two thirds of which are pipe, 65%; calendered sheet and film 10%; molded items 5%

FOREIGN TRADE

Exports—falling to about 450 million lb in 1984, imports—rising rapidly and may exceed 200 million lb in 1984

PRICES

List prices 37 to 45 cents a lb for large-volume grades, discounting less than last year

COMMERCIAL VALUE

$2.5 billion for estimated production, 1984

A banner year is in store for polyvinyl chloride. Vastly improved 1983 production and nearly as good growth in 1984 are expected to go a long way to offset the three bad years of 1980 through 1982.

Production of PVC could hit 7 billion lb in 1984, up 900 million lb from 1983. And since 1983 production was up 800 million lb from 5.3 billion produced the year before, the health of the PVC business seems well recovered in these two years. Production in 1982 was the lowest since 1977, when the same amount was made. The 1983 production matched the previous high in 1979.

Further aiding the health of the PVC industry has been a shakeout of producers and capacity. Nameplate capacity, at one time well over 9 billion lb a year, declined steeply with the last recession and then moved back up. As 1984 began, annual nameplate capacity to make all kinds of PVC totaled about 8.3 billion lb. Some additional capacity is coming on stream during 1984, both as complete production unit additions and as the result of debottlenecking efforts by various producers. By the beginning of 1985, PVC capacity could be up to 8.8 billion lb. Other capacity, long shut-down, might be reactivated and add to the total, but most industry sources doubt if much of this capacity will ever be touched again because of the technological advances that favor building new units over using old units.

If output in 1984 does reach 7 billion lb, then on-stream capacity will have to run at an average rate of nearly 85%. The actual average rate probably will not be quite this good because of additional capacity that will be run during the latter part of 1984.

The 7 billion lb figure for 1984 production, as always, represents a middle ground between optimists' and pessimists' views. The range among market forecasters falls about 300 million lb on either side, from 6.7 billion to 7.3 billion lb.

Optimists cite the strong first quarter in both production and sales of PVC to support their forecasts' topping 7 billion lb. Sales in the quarter, according to data of the Society of the Plastics Industry's Committee on Resin Statistics, exceeded production more than 125 million lb. This inventory reduction, in effect, means that production will have to be increased later to cover the inventory reduction unless demand should slip quite drastically.

The key to most pessimists' arguments comes from forecasts of higher interest rates and reduced housing starts. If interest rates should rise one or two percentage points during the summer, housing starts could decline substantially this fall, according to most economists. This would reduce demand for PVC in pipe, fittings, floor materials, and the various other components of the housing market. Then an inventory reduction could begin in the fourth quarter, reducing demand and, in turn, production to offset the good first half of 1984.

Clearly, both viewpoints rely on the housing markets for PVC forecasts. This is because housing takes about two thirds of PVC production, either in the form of new construction or in repairs and refurbishing. Interest rates influence both areas of housing, too. Since the home owner generally will require a loan for big-ticket improvement items such as fast-growing vinyl siding, interest rates will have some effect on the nonpipe as well as pipe markets.

Pipe of one kind or another accounts for about 40% of PVC consumption. More than half of pipe goes into housing, with commercial construction taking much of the rest. Probably 10% or less of pipe goes into such nonconstruction uses as irrigation.

The nonpipe segment of PVC consumption is spread over a wide range of consumer products, none of which are large enough to affect total demand. Examples are phonograph records, which have grown little in recent years, and bottles, which eventually might grow significantly if bottle-making developments pan out.

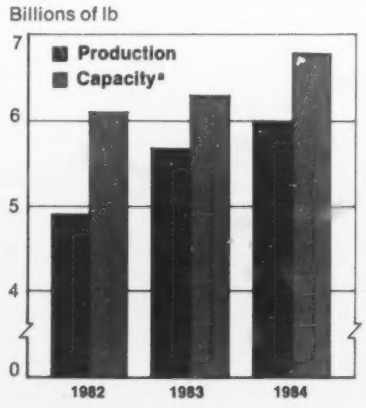
Work on developing new uses for PVC and improving existing uses likely will be expanding now that production has returned to new highs, aiding profitability in making and selling PVC. If the work proves successful, then more good years are in store giving new life to this somewhat mature thermoplastic.

$$-[CH_2-CH_2]-_n$$

High-density polyethylene

- **Demand rise slowing**
- **Capacity up slightly**
- **Prices better**

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Polymerization of ethylene at low pressures aided by metallic salts and alkyls

MAJOR FABRICATED FORMS (U.S.)

Blow-molded items, mainly containers, 40%; injection-molded items 25%; pipe and conduit 10%

FOREIGN TRADE

Exports—expected to be down substantially to 800 million lb in 1984, imports—small, probably will total less than 50 million lb in 1984

PRICES

List prices 38 to 45 cents a lb for large-volume grades, much less discounting last year

COMMERCIAL VALUE

$2.4 billion for estimated production, 1984

High-density polyethylene will continue to have one of the best plant utilization levels of all chemicals in the U.S. But that level this year or any other year will be hazy.

On the surface, capacity use should be quite high during 1984. Production of HDPE this year will be about 6 billion lb, maybe even more. Estimates of plant capacity range from more than 6 billion lb to well over 9 billion lb, the big difference resulting from the amount of linear low-density polyethylene capacity that could be used to make HDPE. Therefore, capacity utilization could range downward from nearly 90% of nameplate capacity—which is 100% of effective capacity—if the LLDPE swing is not counted, to less than 70% of nameplate capacity if it is.

Demand for LLDPE has continued to be surprisingly strong, even as the economic recovery has slowed. Thus, demand for the low-density product could be the controlling factor in the amount of HDPE made in those plants that have swing capacity available.

Any of this swing capacity—estimated at 3.5 million lb—that might be dedicated exclusively to HDPE likely would be small, according to industry sources. All additional capacity that has been put on stream lately—such as Du Pont's new plant near Bay City, Tex., and expansions at existing plants by such companies as Allied and Gulf Oil—is dedicated to produce only HDPE. And even though more expansions are rumored from time to time, the potential of shifting the swing LLDPE capacity tends to dampen such rumors.

With a nameplate total capacity of plants that can make only HDPE of about 6.8 billion lb as the year began, making 6 billion lb in 1984 will require producers to push their plants at an average operating rate of 88%. Some industry sources forecast that 1984 production will be higher than 6 billion lb but believe that capacity will not be strained. Some slack still exists in capacity and perhaps some 100 million to 200 million lb of production could come from the LLDPE plants.

The rate of production growth during 1984 will be just one third that of 1983, as recovery from the recession last year helped HDPE almost as much as any major-volume polymer. However, the demand gain in the U.S. will be greater than the production gain. A decline in exports of more than 150 million lb expected in 1984 will have to be absorbed by U.S. markets. New capacity in foreign countries and the strength of the dollar are behind the expected decline in exports.

The use pattern for HDPE may change slowly as smaller applications such as pipe, film, and sheet grow faster than the big molding uses do. The pipe market covers several kinds of products but is split about half and half between solid-wall and corrugated pipe. A shift is under way toward larger-diameter pipe and thicker-walled pipe, which raises the resin consumption.

The key to the future of film markets for HDPE now seems to be the grocery bag market. Extensive development continues on these bags aimed at overcoming the problem that such bags will not stand up alone or stay open without some kind of holder. The use of other merchandise bags made of HDPE alone or of blends of HDPE and LLDPE is wide and still growing rapidly.

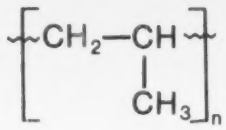
Bottles of various types dominate the blow-molding demand for HDPE, with 1-gal milk bottles taking 80% or more of the food market for such containers. Efforts to replace coated paper in the half-gallon market are handicapped by the usual problem of the cost of the higher polymer-to-bottle volume ratio than for 1-gal bottles. There is also a huge public relations campaign by the makers of paper milk containers to stop inroads of plastic bottles into the market.

Injection molding of HDPE faces some growing competition from polypropylene resins. But the diversity of present and potential uses causes some people to forecast faster growth for injection molding than blow molding.

For HDPE, 1984 will be a test of how well development efforts can sustain consumption growth in the U.S. to absorb the loss of export volume. Even with a slowdown in the economy, HDPE consumption likely will add as much as 9% to 1983 consumption and bring production over 6 billion lb for the year.

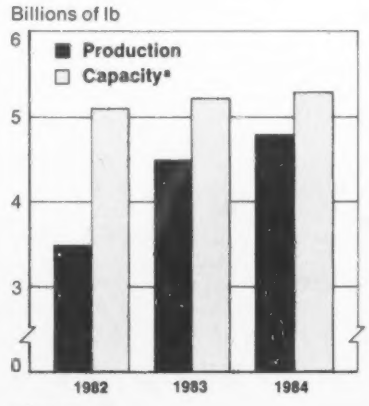
Key Polymers

Polypropylene



- ***Demand growth to slow***
- ***Capacity up a bit***
- ***Prices improved***

PRODUCTION/CAPACITY



[a] First quarter.

HOW MADE

Polymerization of propylene (sometimes with small amounts of comonomers) aided by metallic salts and alkyls

MAJOR FABRICATED FORMS (U.S.)

Injection-molded items 35%, fibers and filaments 35%, film 10%

FOREIGN TRADE

Exports—may decline in 1984 to about 750 million lb, imports—about 10 million lb in 1984

PRICES

List prices 40 to 47 cents a lb for large-volume grades of homopolymers, discounting reduced

COMMERCIAL VALUE

$2.0 billion for estimated production, 1984

Technological change is sweeping through the ranks of polypropylene producers. Although it may not have much impact on demand this year, it could lead to some large changes next year and through the rest of the 1980s.

The change, in the form of gas-phase processing with more active polymerization catalysts, apparently has cut processing costs substantially. The result could be greater cost competitiveness for polypropylene and increased demand beyond forecasts that have been made based on historical prices. But partly offsetting the technological gains in reducing polymer cost has been a shift from the traditional ratio of propylene costing 70% or so of the raw material ethylene; now propylene and ethylene prices are much closer together.

Polypropylene's upward swing in production will abate somewhat during 1984, marketers say. In a fashion similar to other major-volume thermoplastics, the big recovery in production during 1983 will slow, resulting in a 1984 growth rate of about a third the gain last year. Output likely will reach 4.8 billion lb this year, but could go as high as 5 billion lb. First-quarter production of 1.23 billion lb—the figure released by the Society of the Plastics Industry's Committee on Resin Statistics—indicates that production could get quite close to the 5 billion lb-a-year level. However, sales are not so large as production, suggesting that inventory-building has been going on during the quarter and that production might slow later in the year, especially during the third quarter as fabricators shut down for vacations, maintenance, and product line changes.

If production does slow, and the yearly total turns out to be 4.8 billion lb, then existing capacity will be run at an average rate of 90% for the year.

About 200 million lb of polypropylene capacity will be added this year, mainly through debottlenecking of existing units by the use of more efficient catalysts. Some of these expansions—for example, one at Exxon Chemical—are coming on stream gradually. Then, in 1985, another 200 million lb of capacity is expected from the joint venture of Shell Chemical and Union Carbide. The partnership is converting an old high-pressure-process LDPE unit at Seadrift, Tex., to its new low-pressure polypropylene process.

Even if inventory-building is accounting for quite a bit of the production gain so far in 1984, the question of lost sales because of a lack of capacity to supply demand still arises. Generally, marketing experts contacted by C&EN say that loss of sales will be minor in 1984 if the economic recovery is slowing. Next year additional capacity plus the decline in exports would handle demand.

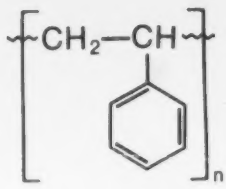
Inventories of polypropylene fabricated items also may have increased rapidly during 1983 and may be overhanging the market now. The thinking behind the product inventory building comes from the large increase in polypropylene production during 1983 of about 1 billion lb. This production gain surprised most market forecasters. The highest gain forecast last year was about 500 million lb, with most forecasts at about 300 million lb. Hence the jump of about a billion pounds sent marketers on a search for where the unexpected production had gone.

Fibers, which run a close second to injection molding as a major form of polypropylene fabrication, now seem to get the nod for where the downstream inventory was built up most rapidly. How serious the inventory of fibers and filaments is to this year's polypropylene growth projections apparently depends on the economy and, in particular, housing. Housing is the most important fiber end use.

The major fabricated end use for polypropylene is in the many injection-molded items ranging from appliance parts to battery cases. Some of these are a part of the durables market and the high-priced products that consumers are buying again. A good bit of the remainder is packaging and other short-lived items. These items likely will bolster polypropylene demand this year as long as the economy stays healthy.

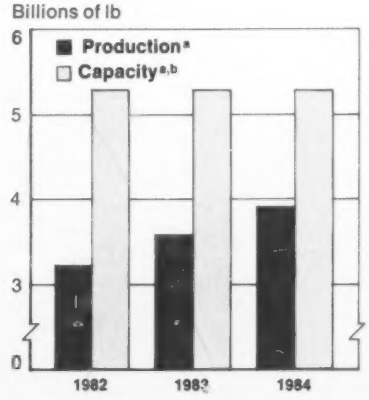
After coming off a year of a very large gain in production, polypropylene likely will be catching its breath in 1984 with just a small gain in output. Later, as the impact of technological developments appears, a new big round of capacity building may be in store for this key polymer.

Polystyrene



- ***Demand growth slower***
- ***Capacity on hold***
- ***Prices up some***

PRODUCTION/CAPACITY



a All forms. b First quarter.

HOW MADE

Polymerization of styrene using initiators

MAJOR FABRICATED FORMS (U.S.)

Injection-molded items 40%, extruded items 35%, expandable beads 15%

FOREIGN TRADE

Exports—small, holding at 50 million to 100 million lb in 1984, imports—about 10 million lb in 1984

PRICES

List prices 42 to 48 cents a lb for large-volume grades, discounting lessening

COMMERCIAL VALUE

$1.6 billion for estimated production, 1984

Polystyrene producers are looking for some developments that will add sparkle to their business. Several prospects, such as expandable polystyrene beads and audio and video cartridges, reels, and cases, have appeared on the horizon but none have turned out to be the real incentive to growth needed. As a result, polystyrene is headed again for another year of only modest growth.

Production of polystyrene in 1984 could be up 300 million lb, or 8%, from 1983 to 3.9 billion lb. That still would be below the historical high for polystyrene production of just over 4 billion lb in 1979. Some industry sources, however, feel that production this year will not be up more than 5% because of a slowing in the economy.

Capacity to make polystyrene has been on hold for some time—hovering at about 5.3 billion lb. The overcapacity created has been putting pressure on prices for some time, too, a euphemism, according to one source, that means profits have been none or meager. Depending on the estimates of 1984 polystyrene production, the in-place capacity at the beginning of the year will be run at an average rate of 70 to 74%. As has been the case in recent years, this operating rate will be the lowest among the major-volume thermoplastics.

In spite of the seemingly chronic overcapacity, some expansions are coming along, even as part of the existing capacity remains shut down. Gulf Oil, for example, soon will be completing an expansion of its Marietta, Ohio, plant that will add 130 million lb per year there. Other debottlenecking expansions could bring another 200 million lb of additional capacity by the beginning of 1985.

How much capacity will be scrapped is difficult to estimate. Production technology has become relatively simple, making retention of older plants a bit easier to justify. These long-shut-down plants could be restarted five years later, according to some industry observers, and still be reasonably competitive. But if growth in polystyrene doesn't speed up, it could be the end of the decade before all capacity now in place would be needed.

Demand growth for polystyrene seems always to be blunted by one kind of competing development or another. For example, producers at one time said expandable polystyrene beads pull up demand for polystyrene strongly. But during the recent recession, demand for these beads remained flat. Admittedly, this is better than a decline, which occurred for most other major uses of polystyrene, but still it has been a disappointment to producers. Now, beads may be back on the high-growth trail, but their outlook depends strongly on the insulation market, which, in turn, depends on home building. In 1984, producers hope that demand for beads will break away from the holding pattern of about 450 million lb annually, a level first reached in 1979. The relatively high selling price of beads—15 to 20 cents per lb more than for conventional polystyrenes—may have attracted too many producers to this segment of the business and has caused considerable overcapacity.

In other areas of use, polystyrene continuously feels the pressure of other polymers such as relative newcomer polypropylene. Although various developments are helping, polystyrene often is replaced by other polymers because of its brittleness.

Injection-molded components of audio and video cartridges could push polystyrene to higher growth. Some sources view these cartridges as major potential markets because of the sales growth in home video cassette recorders (VCR). With a pound or more of polystyrene in each cartridge case and reels, volumes now are forecast in the 100 million to 200 million lb-a-year range for home VCR cartridges alone. Additional quantities are needed for commercial cartridges and for the smaller-volume application in audio cassettes.

Polystyrene demand might be helped by developments such as performance-impact polystyrene for uses where even higher impact resistance is needed, and by various upgraded rubber-modified polystyrenes aimed at some of the acrylonitrile-butadiene-styrene polymers' markets. As yet, these products are used in small volume. However, it will take a long time before these developmental products add much to total polystyrene demand.

U.S., Canada Weigh Possibility of Petrochemical Free Trade

Canada has initiated duty-free trade proposal and U.S. government is receptive, but U.S. industry has adopted wait-and-see attitude

Earl V. Anderson, C&EN New York

Like Lazarus of biblical fame, the idea of freer, if not completely free, trade between the U.S. and Canada has been raised from the dead. In both countries, influential political and business leaders are now solidly in favor of negotiating duty-free trade in several industrial sectors.

If the idea becomes a reality—and there is an excellent chance that it will—petrochemicals will be in the forefront of the strongest assault toward bilateral free trade between the two countries since they signed the duty-free automotive trade agreement in 1965.

Certainly chemical industry leaders on both sides of the border are taking the possibility very seriously. Already, two lengthy meetings on the subject have been held between the Chemical Manufacturers Association and its Canadian counterpart, the Canadian Chemical Producers Association (CCPA).

Officials of both organizations emphasize that their meetings were only preliminary and exploratory. "They absolutely were not negotiations," says one official; "only governments can negotiate." Nevertheless, CCPA has produced a "preliminary" list of 26 petrochemicals on which it would like to see two-way, duty-free trade between Canada and the U.S.

This list very well could be accepted by the Canadian government as a starting point for sectoral trade negotiations in petrochemicals if and when such negotiations get under way. And it's amost certain that, if petrochemical trade talks do take place, that list will be peppered with proposals to remove some products and to add others.

So far, negotiations haven't been scheduled. But optimism that they will be held never has been higher.

One reason for that optimism is that this time Canada initiated the proposal for sectoral free trade. Last fall, Ottawa issued a major report outlining a new approach to Canadian trade policies for the 1980s. And, in a major policy switch, it recommended sectoral free trade with the U.S. for selected industries.

No longer is there so much worry about too much dependence on U.S. markets. Instead, the concern is how to retain, and even increase, market share in the U.S. As one Canadian businessman put it, "Ottawa has made a virtue out of necessity."

Despite these changing attitudes in Canada, a completely free trade arrangement with the U.S., such as a free trade area or a customs union, still would be hard to sell north of the border. But duty-free trade limited to some specific industrial sectors could be more palatable.

The Canadian initiative has received a warm welcome among U.S. trade officials. William Brock, the U.S. Trade Representative, has had several talks about sectoral free trade with Canada's minister of international trade, Gerald Regan.

As a result of these meetings, four sectors now are "under active consideration" by the Canadian and U.S. governments. These four sectors are agricultural equipment and inputs (which may include agricultural chemicals), steel (both carbon steel and specialty steel), computer services, and government procurement of mass transit equipment.

These four are considered the priority sectors, presumably because officials anticipate fewer problems negotiating free trade with them than with other sectors. And officials on both sides want to start off with successes, not failures.

Later, of course, other industrial sectors can be added to the sectoral free trade agenda. Petrochemicals rank high among them. The petrochemical industry was listed in Canada's original policy statement endorsing sectoral free trade. In fact, petrochemicals have been candidates for some form of liberalized trade between the two countries for some time.

Immediately after the Tokyo round of multilateral trade negotiations in the late 1970s, proposals for duty-

26 products proposed for duty-free trade

Styrene	Ethylene glycol	Polyvinyl chloride
Cyclohexane	Phenol	Polystyrene
Ethylbenzene	Acetic anhydride	Vinyl acetate
Carbon tetrachloride	Acetic acid	Styrene-butadiene latex
Ethylene dichloride	Adipic acid	Acetaldehyde
Vinyl chloride	Hexamethylenediamine	Adiponitrile
Propanol	Acrylonitrile	Nylon 6
Methanol	Alkylbenzene	Nylon 66
Ethylene oxide	Polyethylene	

Canada is a major supplier of many U.S. chemical imports

$ Millions	U.S. chemical imports		
	Canada	Total	% Canada
Organic chemicals	$517.5	$3476.6	14.9%
Benzene	47.1	206.1	22.9
Toluene	55.8	99.6	56.0
Xylene, nec	48.2	57.0	84.6
Styrene	8.6	25.4	33.9
Cyclic organics, nec	35.1	571.8	6.1
Vanillin	12.2	14.5	84.1
Butadiene, butylene, ethylene, propylene	130.9	345.3	37.9
Perchloroethylene	3.9	8.0	48.8
Halogenated hydrocarbons, nec	18.7	65.1	28.7
Ethanol (nonbeverage)	13.0	102.0	12.8
Octanol	14.6	21.4	68.2
Ethylene glycol	4.6	9.8	46.9
Alcohols, esters, ethers, nec	57.8	139.6	41.4
Ethylene oxide	2.6	2.7	96.3
Propylene oxide	13.2	13.2	100.0
Nitrogenous compounds, nec	7.7	383.9	2.0
Inorganic chemicals	559.4	1615.8	34.6
Sulfur	62.5	129.1	48.4
Chlorine	20.7	20.7	100.0
Carbon black	11.3	17.1	66.1
Chemical elements & base metals, nec	15.4	18.8	81.9
Sulfuric acid	7.8	11.7	66.7
Hydrofluoric acid	31.5	79.1	39.8
Zinc oxide (not containing lead)	15.6	26.4	59.1
Titanium dioxide	27.4	167.7	16.3
Ammonia, anhydrous, liquid anhydrous & aqua	111.4	344.6	32.3
Aluminum oxide abrasives, crude	52.7	53.7	98.1
Sodium hydroxide	41.3	61.1	67.6
Nickel oxide	12.7	19.1	66.5
Calcium cyanide & silicon carbide	34.7	39.7	87.4
Sodium chlorate	35.0	35.2	99.4
Sodium sulfate, crude	7.6	9.8	77.6
Sodium sulfate, anhydrous	14.5	17.5	82.9
Inorganics, nec	10.8	157.1	6.9
Radioactive & associated materials	201.2	951.7	21.1
Dyeing, tanning & coloring materials	2.0	299.5	0.7
Pigments, paints & varnishes	19.0	145.5	13.1
Medicinals & pharmaceuticals	28.2	702.6	4.0
Flavors, perfumes, cosmetics & toiletries	18.6	370.2	5.0
Cleaning & polishing materials	18.7	90.3	20.8
Fertilizers, manufactured	740.2	997.2	74.2
Ammonium nitrate, all forms	52.6	60.9	86.4
Urea	112.1	235.9	47.5
Ammonium sulfate, all forms	18.0	24.1	74.7
Nitrogen solutions	12.5	23.9	52.3
Potassium chloride (or muriate of potash)	485.1	547.8	88.6
Diammonium phosphate	6.8	9.3	73.1
Ammonium phosphates, nec	22.7	26.4	86.0
Fertilizer materials, nec	25.7	28.1	91.5
Explosives and pyrotechnics	19.9	64.5	31.3
Plastics and resins	184.1	1097.6	16.8
Low-density polyethylene	11.6	29.2	39.7
High-density polyethylene	6.6	12.7	52.0
Polypropylene	0.8	5.1	15.7
Rubber, synthetic	4.2	19.6	21.4
ABS	4.2	24.2	17.4
PVC	26.6	53.7	49.5
Synthetic resins & plastic materials in primary form, nec	18.1	120.0	15.1
Plastics products	98.0	594.2	16.5
Pesticides & disinfectants	10.3	251.2	4.0
Miscellaneous chemical products	60.6	716.8	8.5

nec = not elsewhere classified. Source: U.S. Bureau of the Census

free shipment of Canadian petrochemicals to the U.S. began to surface. Most of the proposals came out of Alberta where a fledgling world-scale petrochemical industry was taking shape. Canadian petrochemical industry representatives suggested duty-free entrance for about a dozen Canadian petrochemicals, all of them "commodity" type products and most of them first or second ethylene derivatives. In exchange, the U.S. would receive favorable treatment on Canadian natural gas exports.

This proposal died along with other proposals made at about the same time for some form of North American trade alliance encompassing the U.S., Canada, and Mexico (C&EN, July 14, 1980, page 12). But it resurfaced in the Canadian government's trade policy statement last year and again this year in a task force report on petrochemicals that industry prepared for Ottawa.

It should not be surprising that chemicals in general, and petrochemicals in particular, should be considered for special trade treatment. A lot of chemical trade takes place between the two countries. And a lot of this trade already is duty-free.

That trade represents a greater proportion of the total for Canada than it does for the U.S. For instance, last year Canada exported $2.4 billion in chemicals to the U.S. and imported $2.5 billion from it (U.S. data). For Canada those figures mean 65% of total chemical exports and a hefty 78% of total chemical imports.

Canada's share of U.S. chemical trade isn't that overpowering, but it isn't small change, either. Last year, Canada took 12% of all U.S. chemical exports and provided 22% of all its chemical imports.

For some petrochemicals, free trade already exists between Canada and the U.S. For instance, fertilizer materials such as ammonia and urea move duty-free. Tariffs have been negotiated away on such primary petrochemicals as benzene, toluene, xylene, ethylene, propylene, and butylene. Canada exports large volumes of these products to the U.S.

However, tariffs still exist on

many first- and second-generation derivatives. And it is toward eliminating these tariffs that CCPA's list of 26 is aimed. But that list and the meetings between CCPA and CMA are only the first step along a long road to successful government negotiations in petrochemical free trade. Nobody in either the U.S. or Canadian petrochemical industries expects that list to survive the trip intact.

In the U.S., most of the industry work concerning sectoral free trade with Canada is concentrated in CMA and the Office of the Chemical Industry Trade Adviser (OCITA). Right now, however, most of that effort involves collecting information and disseminating it to OCITA and CMA members.

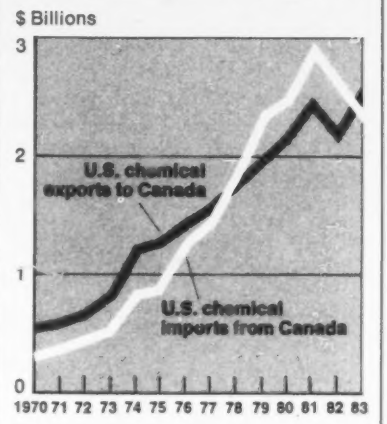
Myron T. Foveaux, CMA's assistant director of government relations and a leading industry trade expert, says that CMA can do only so much for its members on this issue. At the moment, CCPA's proposal is relatively simple—have two-way, duty-free trade on the products on its list.

But if balanced benefits are to be achieved within each sector, achieving it with this narrowly defined list could prove difficult, if not impossible. When the Canadian government presents the list to the U.S. negotiators, U.S. chemical companies will be waiting in line to make their own counterproposals, striking some chemicals from the CCPA list and adding others.

Don't expect a counter list from CMA, however. CMA, says Foveaux, is in no position to offer lists of products. First, it doesn't represent the entire chemical industry. And what it might propose to help one member could end up harming another. "We want no part of that," says Foveaux.

The opportunity for U.S. companies to make their own suggestions will come when the federal government holds its own investigations. Typically in such cases, these could include hearings before the International Trade Commission and/or the Trade Policy Staff Committee, a high-powered interagency group chaired by USTR. Industry input also could funnel into the trade representative's office through the industry sector advisory committee that handles chemicals.

U.S. chemical trade with Canada returns to surplus



Source: U.S. Bureau of the Census

The outcome of such a process could be an industry-suggested list that would look quite a bit different from CCPA's list. Depending upon how "petrochemicals" are defined—and that hasn't been pinpointed yet—a list more to the appetite of some U.S. companies could go further toward downstream products than Canadian chemical leaders care to go.

Rolland G. Frakes, senior vice president, Novacor Chemicals, Calgary, and chairman of CCPA's trade committee, says that he and his Canadian cohorts recognize that there will be some deletions and additions to the CCPA list. But they would like to keep future negotiations confined as much as possible to basic petrochemicals, without too many upgraded products involved. "We're not as far out of balance in petrochemicals as many think," says Frakes.

He thinks that the next step should be for "real professionals" to make a thorough economic evaluation of the proposals. But that may have to wait until the two governments give industry experts a target to shoot at.

It is hard to say when that might happen, on the U.S. side at least. Petrochemicals still are "under consideration" by the U.S. trade representative's office. But, as William S. Merkin, deputy assistant U.S. trade representative for the Americas, points out, there are four joint working groups working on the four priority sectors, and that does not represent a commitment to negotiate.

The petrochemical sector has no working group yet, and one would not even be considered until the two countries' top trade officials meet again this fall. But there are hints that the U.S. trade office may not wait until then to at least get ITC involved in an economic impact analysis.

Meanwhile, there remains the problem of reconciling any sectoral free trade arrangement with the international trade treaty already in effect, the General Agreement on Tariffs & Trade, or GATT. Under GATT rules, such agreements should cover essentially all trade.

"We haven't resolved this issue yet," says Merkin. There really are only two ways to go, he says. One is a GATT article that provides for free trade areas; the other is to seek a waiver as the two countries did for the automotive agreement in 1965.

The waiver was granted in 1965. Things are different now. Other trading partners may not be in any mood to grant waivers.

Merkin notes, however, that of the 40 or so free trade arrangements reported to GATT, none really encompass total free trade. Most are in the 50 to 60% range; some go as low as 10%. Certainly any sectoral free trade arrangements reached by Canada and the U.S., on top of the large volume of duty-free trade that already exists, could qualify under GATT by those standards.

Despite the problems involved, chemical trade experts in the U.S. and Canada seem confident that some sort of sectoral trade arrangement will be completed for petrochemicals. CMA's Foveaux notes that "this is the farthest it has gone so far."

CCPA's Frakes says that a free trade agreement should fly because both sides are concerned about the influx of new producers onto the world petrochemical scene. "We should be looking at what it would be like if North America were one chemical market instead of two," he says. □